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CONTENTS

UTILIZATION OF RESOURCES AND SUPPLY

Better Supply of Scientific Organizations Sought
(L. L. Rumyantsev, L. A. Flerov; EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, Jul 80) 1

ECONOMIC MODELING AND COMPUTER TECHNOLOGY APPLICATION

Certain Problems in Constructing Interindustrial Dynamic Models
(Ye. A. Rogovskiy; IZVESTIYA AKADEMII NAUK SSSR-SERIYA ECKONOMICHESKAYA, May-Jun 80) 8

REGIONAL DEVELOPMENT

Economic Interrelationships Between Republics Analyzed
(A. Yablonskis; EKONOMICHESKIYE NAUKI, Jul 80) 17

INTRODUCTION OF NEW TECHNOLOGY

Special Fund for Financing New Technology Described
(V. Pokrovskiy; PLANOVOYE KHOZYAYSTVO, Aug 80) 23

UTILIZATION OF RESOURCES AND SUPPLY

BETTER SUPPLY OF SCIENTIFIC ORGANIZATIONS SOUGHT

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 7, Jul 80 pp 65-73

[Article by L. L. Rumyantsev, chief of the Lenorgnauchkomplektsnab Administration, and L. A. Flerov, head of the Leningrad Division of NIIMS of USSR Gossnab: "How To Improve Supply to Science"]

[Text] We believe that is would be wise to identify scientific research organizations as a priority group and plan material-technical resources for them separately.* Supply to science would then be carried on entirely by wholesale channels for the full assortment of goods used by science. Preliminary requests would not be needed, with the single exception of special-purpose goods needed in small quantities.

Experience with supplying science in this way already exists. Special administrations called "orgnauchkomplektosnaby" [organizations for supply to science] were set up in Leningrad, Odessa, and Kazan' in 1969 as an experiment by USSR Gossnab. Another in Minsk was added later. Their job was to solve the problems of supply to research organizations. In the orgnauchkomplektosnaby the scientific organizations had for the first time organizations that specializes in satisfying their needs for material goods.

The formation of these special administrations had a positive effect on service to the customers. Thus, within three years of its establishment, the Leningrad Orgnauchkomplektsnab Administration was able to stop collecting preliminary requests and switch to supplying scientific organizations through wholesale channels for the entire assortment list of USSR Gossnab. This was made possible by consistent study of the demand for production-technical goods in the region and the establishment of necessary stockpiles of material resources, some obtained by decentralized purchase. The administration was able not only to identify current demand for goods, but also to compile medium-term

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* Science today consumes no more than one percent of the means of production used in the national economy.

(3-5 years) forecasts. Similar work in Odessa, Kazan', and Minsk provided rich experience with supplying science on the new, progressive basis.

Supply Based on Operational Orders

The next step to improve supply to scientific organizations and serve them through wholsesale channels was the system established by USSR Gossnab, in cooperation with 14 ministries and departments, where territorial supply organizations were given resources for the whole assortment of products distributed by the manufacturing ministries and departments. The new system, by concentrating all material resources in the same place, permitted operational and flexible supply to scientific organizations.

The preconditions were set for organizing comprehensive supply, where all essential goods are delivered according to orders based on contracts concluded between the supply and marketing organization and the users. In the Leningrad territorial region today 319 scientific research, planning-design, and technological organizations and 20 higher educational institutions and other schools have been switched to the system of supply by order. In 1978 these organizations submitted roughly 10,000 orders with 28,700 items. Odessa, Minsk, and Kazan' have also begun switching research organizations to the system of supply by operational order.

The new form of supply has major advantages over the traditional way of supplying needed goods based on preliminary requests. The customer now has the right to submit an order at any time for delivery of needed raw materials, processed articles, assembly components, instruments, and the like. Delivery is guaranteed within 14 days within the city; for out-of-town customers shipment in 14 days is guaranteed.

Experience has shown that the change to service based on operational orders has had a beneficial effect on the work of scientific organizations: the time of experiments has been shortened; production stockpiles have been reduced; cases of acquiring materials and equipment "just in case" have become less common. The work of supply and marketing organizations has improved; under the new conditions which allow them to concentrate material resources they have been able to improve the flexibility of operations and supply customers with all necessary goods more fully and quickly, practically without enlarging their stocks of goods.

It would appear that the USSR main administrations of supply and marketing should take steps, based on accurate figures on the range of goods in demand, to establish the necessary stockpiles of goods at supply organizations engaged in supplying science. At the administrations of material-technical supply (UMTS's) which have special subdivisions for supply to scientific organizations, it would be wise to establish a network of wholesale stores to sell small quantities of material goods to small customers with delivery on a centralized basis. These steps would significantly promote stability and timeliness in meeting the needs of research organizations.

Equipment Rental

The study of demand from scientific organizations showed that they need many instruments and equipment for experiments that last only a short time. They use the equipment they have purchased only occasionally, and many times just once. That is why it became very timely and necessary in 1970 to organize rental of measuring equipment at the UMTS of the Leningrad region; the same system was instituted later in several other cities (Odessa, Kazan', Minsk, and Moscow).

This form of supplying technical equipment has already become fairly widespread. There are 23 equipment rental points operating today in different territorial regions within the USSR Gossnab system. The rental stock of instruments, apparatus, and other equipment had a value of about 20 million rubles (approximately 35,500 units) in 1979 and is still growing. The number of customers using rental service has reached 6,500; more than 60 percent of them are scientific organizations. According to the master plan developed by NIIMS (Scientific Research Institute of the Economic and Organization of Material-Technical Supply) another 30 rental points will go into operation by the end of the current five-year plan, which will make it possible to meet temporary equipment needs of practically all the major scientific research centers in the country.

Rental is economically advantageous to everyone. Operational deliveries outside allocated resources, the possibility of greatly (threefold and more) raising the use coefficient of the equipment, and the relatively low rate for using equipment (4-6 percent of the price per month, which is quite important for small and medium-sized organizations) -- these are the progressive features of the new form of material-technical supply. Another advantage of rental, and one that was immediately prasied by the customers, is the guarantee that the rental items will be in good working condition and delivered on a centralized basis.

The rental system is growing quite fast in the Leningrad region and several others, chiefly where orgnauchkomplektsnaby are in operation. For example, in 1971 the corresponding service of the Leningrad Orgnauchkomplektsnab Administration had 464 instruments of 82 types with a total value of 257,000 rubles. By the end of 1979 the rental stock was worth 3.3 million rubles and comprised 4,160 units of 510 types. The number of customers had risen from 57 to 1,150. Along with growth in the assortment and size of the rental stock its economic impact also rose, from 170,000 rubles in 1971 to 2.8 million rubles in 1979.

In Odessa the stock of rental equipment grew 16-fold in seven years to a value of 1.6 million rubles (2,515 units); the annual economic impact there in 1979 was 1.2 million rubles. The rental system has grown rapidly in Moscow. The value of the stock of rental instruments and equipment there reached 2.4 million rubles by the end of 1979, and the service was used by more than 1,000 customers.

It should be noted, however, that the rental points now operating within the USSR Gossnab system meet only 10-15 percent of the demand. The reason for this is the shortage of resources allocated from the center to build the rental stock. The Leningrad rental department, for example, needed instruments and equipment with a value of 1,310,000 rubles in 1978, but only 269,000 rubles worth was allocated. The Odessa department received only one-fifth of the 570 instruments it ordered from the center. The situation is similar in other areas. This results in significant decentralized purchases of equipment, which, of course, involves difficulties "hunting it down" and also usually results in purchase of goods that are not in consistent demand.

The items allocated on a centralized basis to the rental services are mostly instruments and equipment produced by the USSR Ministry of Instrument Making, Automation Equipment and Control Systems and distributed by USSR Gossnab. The equipment is still in short supply, especially radio measuring, optical, and spectral apparatus and up-to-date instruments for physico-chemical analyses. The manufacturing ministries distribute these goods.

Because organizations affiliated with many ministries and departments have an interest in renting equipment for scientific experiments, it appears advisable to draw on their resources on a share basis to establish rental stock. In 1974-1978 scientific research and other organizations of the Ministry of Instrument Making, Automation Equipment and Control Systems rented 576 instruments worth 425,000 rubles in the Leningrad region and higher educational institutions rented 2,225 instruments worth a total of 1,880,000 rubles. In all, organizations belonging to 24 ministries and departments were covered by the analysis. During these years they rented more than 6,500 instruments with a total value of 5,230,000 rubles.

The scientific research organizations, who make up the bulk of rental equipment customers, continue to buy many instruments and pieces of equipment that they need for only a short time using ministry funds. Each year the Leningrad Orgnauchkomplektsnab Administration alone puts 1.5-2 million rubles worth of such equipment into circulation. USSR Gosplan, the State Committee on Science and Technology, and the ministries and departments should, it would seem, review the norms of allocations of instruments and equipment to scientific organizations and increase resources devoted to the development and improvement of the rental system accordingly.

When rental departments offer equipment for temporary use they guarantee that it will be in good working condition. Services to repair and inspect instruments and equipment have been set up to assure this. They perform up to 60 percent of all necessary repair and inspection work and at the same time check to see that customers use the equipment properly. These activities, it has been shown, make it possible to extend the working life of the rental resources 15-20 percent. The work would be even more effective if the USSR State Committee on Standards took a broader part in the organization of partial repair and inspection of instruments at its specialized enterprises, gave methodological help, and assisted in setting up repair-inspection services right at the rental points.

Centralized delivery of products is important in organizing material-technical supply and providing customers with better service. This is considered a tight spot in rental activity. For the entire system of rental organizations centralized delivery is only about 25 percent; in Leningrad, Minsk, and Dnepropetrovsk, though, it is approaching 70 percent. A specific need is supplying special small trucks to the rental points. This is not simply a service; it is primarily a way to reduce the likelihood that equipment rented for temporary use will go out of order. This problem also arises from the need for quick delivery of scare instruments and apparatus to the branches that rental organizations are establishing in nearby areas. There are nine such branch offices today, and in the next year or two they will double at a minimum.

An important element in expanding rental relations and raising the level of material supply to scientific organizations is the middleman form of rental. Territorial supply and marketing organizations are acting as the middleman between scientific organizations of their regions and putting equipment belonging to the organizations but temporarily not being used by them into economic circulation. The potential scale of this reserve for supplying equipment can be judged by the fact that the stock of instruments of sectorial scientific research organizations alone is about 6 billion rubles in the country today, and roughly 10 percent of this is equipment that is only needed occasionally. If the matter were handled correctly, at least 600 million rubles worth of equipment could be put into use on the basis of rental through a middleman.

The Leningrad Orgnachkomplektsnab Administration has taken the first step in this direction. It has a special office, which at present has just two employees, which studies the needs and available resources of the various organizations and informs interested parties concerning equipment available and the conditions under which it can be rented temporarily. In its first three months of work the service has not shown any impressive results (an agreement has been concluded with 24 organizations which have offered 33 instruments for temporary use on the basis of invoices issued). But when a number of organizational and methodological problems are resolved and some experience is accumulated, experts believe that this activity may take on large scope.

Provide Comprehensive Services

The services of supply organizations are becoming increasingly important in improving the quality of service to customers and using material resources more economically and efficiently. Transportation dispatching, drawing surplus and unneeded items into economic circulation, printing work, information service to customers, and other types of service are found quite widely in the practical work of supply and marketing organizations, including specialized subdivisions for supply to science.

Information service to scientific organizations on questions of material-technical supply is expanding rapidly in Leningrad and Odessa. As a rule scientific research organizations cannot receive such information through regular channels of sectorial information and the assistance of territorial supply organizations is just what they need. The reference library of the Leningrad Orgnauchkomplektsnab Administration, for example, contains more than 51,000 documents, including legislative documents and interpretations related to material-technical supply, catalogs, price lists, reference manuals on various types of materials and equipment, prospectuses for new equipment, information on articles being taken out of production, and the like. In 1978 the information service of this administration answered 3,800 queries from 211 organizations. In Odessa this service, based on a reference library containing more than 30,000 documents of similar types, is offered to 160 research organizations on a contract basis.

Another important middleman service provided to scientific organizations is placing orders for and producing forms for planning and design documents. The Leningrad Orgnauchnokomplektsnab Administration, for example, places orders for printing, and later sells to customers, about 13 million copies of standard design forms of the unified design document system (YeSKD). This frees planners and designers of the necessity of drawing logos and frames and affords a significant savings of paper. The annual economic effect from this activity reaches 800,000 rubles. Continued expansion of this activity to encompass the largest possible number of research organizations will make it economically advantageous to set up in-house priting facilities with up-to-date equipment that will permite broad use of cliche and rotary printing.

Reconstruction of the Nauka supply depot in the Leningrad region has been started. Plans envision increasing the covered storage area by 25-30 percent. The question of building a production-storage complex that will make it possible to double the usable space of storehouses is in the decision stage. Plans for the complex include an equipment rental enterprise with 10-15 million rubles worth of rental equipment, administrative quarters, and sections to reproduce technical documents, do photographic work, and the like.

In 1977 the Odessa territorial administration began construction of a Center for Service to Scientific Organizations. The work is being paid for on a share basis by the various ministries whose organizations are served by the Odessa Orgnauchkomplektsnab Administration.

Unfortunately, production-type services such as cutting out metal, paper, and cable-wire products, packaging loose materials and metal articles, and the like have not become as important as they should be among the services offered to research organizations. Some changes have been made, but the demand still exceeds supply. In 1978 the UMTS of the Leningrad region, for example, was able to perform only 10 of the 16 orders received from research organizations for cutting out rolled metal products. The situation is similar with other such production services.

The establishment of up-to-date material-technical facilities to serve scientific organizations in two cities of the country does not solve the problem as a whole. Similar work must be organized everywhere. Centralized capital investment is needed in addition to the internal reserves of the territorial administrations. In our opinion, we also need model plans of Centers for Service to Scientific Organizations. This is even more important because USSR Gossnab has now decided to go ahead with setting up special subdivisions for material-technical supply to science in 14 more regions. Other regions are also waiting in line.

Broad dissemination of progressive forms and methods of serving scientific research organizations and establishing conditions for full and timely supply of progressive equipment to scientists will be a means to furthering the productivity of domestic science.

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CERTAIN PROBLEMS IN CONSTRUCTING INTERINDUSTRIAL DYNAMIC MODELS

Moscow IZVESTIYA AKADEMII NAUK SSSR-SERIYA ECKONOMICHESKAYA in Russian No 3, May-Jun 80 pp 94-99

[Article by Ye. A. Rogovskiy]

[Text] The dynamic properties of trajectories-solutions of a broad set of interindustrial models, which use indices of industrial average annual funds, are investigated in the article. An economic interpretation of the property (common for this class of models) of relative instability (stability) is given; the reasons for the origin of deviations in components of a trajectory-solution, which are related to the dynamics of the basic capital are revealed. A possible mechanism for providing stability of a trajectory-solution by means of a correction of the conversion coefficient for increases of basic capital in the average annual equation is also examined.

Currently in Soviet economic-mathematical literature there is confirmation of a valid viewpoint that the use of dynamic models of interindustrial balance is opening up many possibilities for the growth of prospective interindustrial calculations. The difficulties related to construction of this class of applied models and calculations based on them are well known. Above all the difficulties are related to the great instability of a solution to the dynamic models. Inaccuracy in determining the values of exogenic parameters frequently lead to the inadequate nature of its solution for purposes of developing a model.

An extensive literature in which works by E. F. Baranov, V. A. Volkonskiy, M. A. Gershenzon, V. V. Kosov, F. N. Kotsvog, N. F. Shatilov, Ya. M. Urinson and other Soviet researchers stand out, is devoted to theoretical analysis of dynamic interindustrial models. Nevertheless, a theoretical analysis of this class of economic-mathematical models is far from complete and at the present time it still does not correspond to the increased complexity of applied problems.

The combined prospective calculations of the interindustrial structure of the economy, as a rule, have the goal of determining the general tendencies in the development of industries and the agreement of these tendencies with hypotheses for the growth and use element (net). The very formulation of this goal suggests, first, a definite "smoothness" of the dynamics of the development of industries in the national economy, i.e. the solution of a dynamic model--and second, an allowance for imprecision in determining the values of gross output, basic capital, etc. in each specific year of a prospective period.

We shall dwell on one of these basic problems of dynamic interindustrial models--the feature of so-called relative instability. This property of a solution to a model is, in our opinion, sufficiently general and is inherent in the absolute majority of dynamic interindustrial models. Formulated from a formal mathematical point of view, it has still not received a meaningful economic interpretation. As will be shown later, it is precisely the presence of the property of relative instability which leads to nonuniform dynamics of industrial capital outlays in rates of growth of capital creating industries in the solution of a model.

Finding such a property of a solution in many dynamic models has lead them in particular, to the creation of applied models of the so-called "exponential" type, in which the rates of growth of all industries (for capital outlays) are assumed a priori to be invariable throughout the entire accounting period. Among the models of this kind note in particular the models of V.A. Volkonskiy, Ya. M. Urinson and several others.[1]

Disregarding the a priori assumptions of the exponential nature of the dynamics of industry development, we shall examine the following questions: how does one determine and how does the property of relative instability for the solution of a dynamic interindustrial model appear and what does its presence or absence depend on. The answers to these questions enable one to understand the reason of the appearance in the solution to the model, of deviations of capital outlays and rates of growth of capital creating industry which in practice depends very little on the dynamics of the end use of the selection of a model.

In the majority of dynamic (semidynamic) interindustrial models the index of average annual funds is widely used which is defined as the "totality of industrial capital, which is equivalent to the actual amount of fixed capital which changes in the course of a year in the contribution to gross production."[2]

In order to calculate this index (Φ_t) and its increase ($\Delta\Phi_t$) the following relationships are normally used:

a) $$\Phi_t = F_t + m\,(\Delta F_t), \tag{1}$$

b) $$\Delta\Phi_t = m\Delta F_t + (1-m)\,\Delta F_{t-1}, \tag{2}$$

where F_t is the fixed capital at the beginning of the year t, ΔF_t is the increase in fixed capital in the course of a year t: $\Delta F_t = F_{t+1} - F_t$, m is the conversion factor for increase in fixed capital in the average annual equation.

1. Based on the established practice of the nonperiodic start-up of facilities, which are converting to fixed capital balance, two values of the conversion factor for the increase in fixed capital into the average annual equation were established by the methodological instructions for compilation of the state plan for development of the national economy of the USSR: m = 0.35--for all sectors of the industry, m = 0.5--for all remaining industries of the national economy.

In the work by N. F. Taurina different values of this factor, differentiated for sectors of an industry were computed. We shall introduce several of these values:

Sectors of the Industry	m
Ferrous metallurgy	0.25
Fuel industry	0.17
Machine building and metal working	0.22
Construction materials industry	0.27
The industry as a whole	0.25

Given the conditionality of these calculations, which is predetermined by the absence of statistical analysis of the average annual reserves which is adequate for them, one must agree with the fact that the low values of m which have been given reflect the situation which is typical at the given time for individual sectors of USSR industry mainly that in the overwhelming proportion increases in gross production of sectors in a year t are related to full assimilation of fixed capital injected in preceding years (t-1) (t-2), etc. This circumstance, evidently, explains several of the difficulties related to applied calculations based on models of the dynamic interindustrial balance.

As an example it is sufficient to refer to the book by N.F. Shatilov, in which conclusions of the relevance of conversion factors for the increase of capital in relation to a substantial instability of a trajectory-solution to a dynamic interindustrial model with respect to these coefficients are given. Such an instability manifests above all in strong fluctuations in the rates of growth of capital creating sectors: "great fluctuations in capital creating sectors are determined principally by the dynamics of accumulation of basic industrial capital...,--which--... is closely related to coefficients which convert the annual volume of accumulation to an average annual equation."[3]

A result of a theoretical analysis conducted by us, which reveals a close (determining) connection between the values of the sector conversion coefficients for increases in fixed capital into an annual average equation and the dynamic properties of the solution of the interindustrial model, corresponds to the conclusions of N.F. Shatilov. We obtained formal conditions for values of the coefficients being considered, for which the solution of a semidynamic model takes on the property of relative instability."

We shall now examine the qualitative aspect of this complex feature of the trajectory-solution of a model. Here, however, one should note that the principal content of these formal conditions, which are substantial, from a dynamic viewpoint, can be reduced to the following:

--for high values of sector coefficients m $(0.6<m<1.0)$ the solution of a model has a smooth, relatively stable solution;

--for small values of m $(0.0<m<0.5)$ the trajectory-solution experiences strong fluctuations, which are frequently inadequate for the a priori concepts of the possible nature of the change in the sector structure of the national economy.

In later discussions we will base our reasoning on one of the simplest versions of the incremental semidynamic interindustrial model, developed at NIEI [Scientific Research Economic Institute] attached to the USSR Gosplan. The selection of this version of the model is determined by its convenient structure for formal analysis, and also by the fact that by using it as an example we are able to clearly illuminate the content of the common property being investigated. Nevertheless, the experience of calculations and the results of theoretical investigation enable us to expand the conclusions made in our work to other, substantially more complex versions of models of the dynamic interindustrial balance.

In the incremental versions of the semidynamic interindustrial model the notation for determination of $\Delta\Phi_t$ (2) which is permitted relative to ΔF_t is used for determining the increase of fixed capital in the course of a year t:

$$\Delta F_t = \frac{\Delta\Phi_t}{m} - \frac{(1 - m)}{m} \Delta F_{t-1}. \tag{3}$$

Three undesirable features, which in our opinion are a cause of instability in solving the model, are inherent in relation (3) for low values of the coefficient m.

1. As was already noted, the predominant portion of the increase in fixed capital $(1-m)\ F_t$ is in no way related to the problem of industry agreement with production of goods of a given year t. The same can be said of capital outlays related to an increase of ΔF_t.

2. An imprecise assignment of m in the area of their low values is expressed to a significantly greater degree in the calculated volume of the increase of fixed capital than in the area of high values of m. In this case (with a fixed level of use of capital) errors in determining the values of the increase of fixed capital frequently have too great an amplitude of fluctuations and hardly ever enable one to connect the results of the calculations to actual volumes of capital outlays, to the sluggish structure of uncompleted construction, etc.

3. An imprecise determination of the volume of the increase of fixed capital in a preceding time interval of a model (ΔF_{t-1}) for small values m leads to a buildup of the error in ΔF_t. From relation (3) it follows that errors in determining ΔF_t-1, reinforced by the coefficient $\left(\frac{1-m}{m}\right)>1$, enter into ΔF_t with the opposite sign. It is evident that such a kind of relationship is a cause of errors which build up according to an absolute value and which alternate in sign in calculating the need for fixed capital; this in turn leads to the previously mentioned fluctuations in rates of growth in capital creating industries.

By slightly simplifying the formal mathematical aspect of the problem, it is possible to give an approximate economic interpretation to the property of relative stability (instability) of the solution of a dynamic interindustrial model: this is a property, in the presence (absence) of which the solution of a model in the course of step-wise calculations for its prospects is in a condition (not in a condition) to eliminate or balance out errors of the lesser information on the "condition of economics": F_0, X_0, etc.

Commonality of these conclusions is confirmed by analysis of calculations according to a complex model of dynamic interindustrial balance, which was described in the book by N. F. Shatilov. The book mentions the method of artificially increasing the stability of results of calculations which is related to the practical elimination of the coefficient m from equations of the average annual reserves, to removal from the model the very concept of average annual reserves (more precisely their identification with the reserves at the beginning of the year) by exogenic assignment $m_i = 1$, $i = 1, \ldots, n$.

II. We have already examined the case when the conversion factor for the increase in capital in the average annual equation is unchanged in time and independent of any other factors. In this case, the property of relative stability (instability) cannot disappear or appear in any segment of the trajectory. This property, as was shown earlier, is determined by the totality of given industry values of m_i and, insofar as they are assumed to be unchanged, would be inherent for the entire trajectory, and for any segment of it.

The determining influence on the dynamics of fixed capital in the course of the year will be the distribution of their inputs. No doubts are raised by the fact that in the USSR economy distribution of inputs in the course of a year can depend upon what place a given year occupies in the 5-year plan, or what volume of capacities was assimilated in the preceding year, etc. A multiplicity of factors, among which the more important ones to recognize are the indices of intensity of the annual plan for input of fixed capital, assimilation of production capacities and the general intensity of capital construction, has the most substantial effect on the time periods for the input of fixed capital and assimilation of production capacity. All of this confirms the variability of the coefficient m_i, therefore we will examine them in continuous relation to other parameters.

We shall proceed to a description of two hypothetical mechanisms of such interaction.

The first of these mechanisms stabilizes the dynamics of fixed capital in comparison with the dynamics of gross outputs. Its central component is the inverse connection between the coefficients m_i and the rates of growth of production in sectors of the industry and the national economy. This connection in its simplest form can be presented in the form of a linear relationship:

$$m_{i,t} = \alpha_i \eta_{i,t} + \beta_i, \quad i = 1, \ldots, n, \tag{4}$$

where $\alpha_i > 0$, $0 < \beta_i < 1$, $\eta_{i,t} = (x_{t+1,i}/x_{t,i}) > 1$ is the rate of growth of gross production of goods of the i-th sector.

Relationship (4) can play the role of a most important negative feedback, which stabilizes the solution of a model, compensates for errors in the reference information, increases the adequacy of a model for assignments in planning and forecasting the interindustrial structure of the national economy. When $\alpha_i > 0$ the increase of the rate of growth of an industry leads to an increase in the coefficient m_i, which enables one to achieve a given rate of growth for industry using the least increase in fixed capital due to more rapid assimilation of the smallest amount of industrial capacity. On the other hand, relatively low (for a specific year) rates of growth of an industry on the strength of relationship (4) enable one to lower the values of m_i. In this case the rate of growth of fixed capital can be maintained at the level of preceding years. As we see, the described mechanism is in a condition to substantially smooth the rates of growth of fixed capital with respect to dynamics of gross outputs of industries, and to shifts in the structure of the end product.

The role of the stabilizing mechanism in the realized versions of the dynamic models of interindustrial balance, as a rule, is plagued by the use of capital which is corrected in the course of iterative calculations.

Determining the index of average annual capital, which was done by us earlier, rests on the equivalent of fixed capital according to contribution to gross production. This determination suggests a close interconnection of the values of capital use to production--i.e. the ratio of average annual reserves to gross production of industries (or in the incremental version: the ratio of increase of average annual reserves to the increase of gross production of industries) on the one hand, and the values of the industry conversion factors of fixed capital into the average annual equation on the other hand. The ratios between the values of industry capital use and values of the conversion factors into the average annual equation which meet this interconnection are achieved in the course of iterative calculation by empirical selection of the former for fixed values of m_i. By the way, it is precisely in these iterations that the solution of a model, computed from values of the use of capital and m_i which do not agree with one another, is distinguished by strong fluctuations in rates of growth of capital creating industries, by the appearance of "negative capital outlays" and by other features which are unacceptable from an economic point of view.

Overcoming the effects of relative instability for values of $m_i = 0.35$, $m_i = 0.5$ given in standard fashion by a correction of the industrial uses of capital is, as in known, quite a labor consuming operation. This is easily seen if in formula (3) one substitutes the increase of average annual reserves $\Delta\Phi_t$ for its expression by the use of capital for the increase of gross output of industries.

$$\Delta F_t = \frac{f_t \Delta x_t}{m} - \frac{(1 - m)}{m} \Delta F_{t-1}. \qquad (5)$$

From formula (5) it follows that an attempt at balancing the fluctuations in errors for determining ΔF_{t-1} (see above) by a correction f_t leads to fluctuation in the incremental use of capital itself, which will make it substantially more difficult to base it on this in the future.[5]

Effective functioning of the stabilizing feedback mechanism of relationship (4) type requires the economy to have a specific number of mobile investment resources. Moreover, the action of this mechanism assumes flexibility in the processes of capital consumption, which assumes acceleration (or retardation) of the time periods for input of fixed capital.

The change in the nature of distribution of fixed capital inputs in the course of a year is related in practice, first, to organizing incompleted construction by degree of readiness of facilities and, second, to having in a given year "investments resources" of specific kinds (installation and starting-setup operations, etc).

When there is a general intensity of capital construction and a scarcity of "mobile investment resources" in the national economy an opposite, destabilizing feedback mechanism of m with industry growth rates prevails. Its simplest formal notation coincides with the notation of formula (4) when $\alpha_i < 0$. The total action of the two described mechanisms on interindustrial dynamics of the growth of the national economy can also be revealed by the quantitatively measured means of joint evaluation of the entire system of relationships of type (4) simultaneously for all industries.

In conclusion we should note that in order to obtain relative stability for solution of a dynamic interindustrial model the portion of "investment resources" can be exogenically reserved and correlated to the requirement for assuring a given configuration of the distribution of input for fixed capital in the course of a year. In this case the rate of the economic growth, which corresponds to the solution of a model, can be lower (than in the case of the presence of such a reserve); however, this increase will be stable (in the sense mentioned above). Thus, even in the example of a simple determined model it is possible to illustrate the contradiction between the maximally possible rates of economic growth and its stability. This viewpoint agrees with the conclusions of N. Ya. Petrikov, V.I. Rotar', which are of a substantially more general nature and are connected to an analysis of undetermined models.[6]

FOOTNOTES

1. See, for example, Belen'kiy V.Z., Volokonskiy V.A., Pavlov N.V. Dynamic interindustrial models, their utilization for calculations of a plan and prices and economic analysis. "Ekonomika i matematicheskiye metody," Volume VIII, Issue 4 1972; Urinson, Ya.M. Interindustrial models in combined economic calculations. "Ekonomika i matematicheskiye metody," Volume XI, Issue 4 1975.

2. See Taurina N.F. Modeling the interaction of gross production and basic industrial capital as consideration of the dynamics of the change. In the collection: Ekonomiko-matematicheskoye modelirovaniye protsessov rasshirennogeo vosproizvodstva. M., rotaprint of NIEI attached to the USSR Gosplan, 1972.

3. Shatilov N. F. Analysis of relationship of a socialist expanded production and experience with its modeling. Novosibirsk "Nauka," 1974, p 213.

4. See Rogovskiy Ya. A. On utilization of interindustrial main line models in long term planning. In the collection: Problems of creating ASPR [Automation System of Planning Calculations]. M., Rotaprint of GVTS [Main Computing Center] of USSR Gosplan, Issue 11, 1977.

5. Now it becomes clear that the swing of fluctuations in coefficients of output-capital ratio are less as the values of m are greater. Evidently, it is precisely this circumstance which justifies the utilization of the above mentioned artificial method for eliminating the index of average annual reserves from the model in practical calculations.

6. Petrakov N. Ya., Rotar' V.I. On one approach to the problem of stabilization of economic growth. "Ekonomika i matematicheskiye metody," Volume XIV, Issue 6, 1978.

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REGIONAL DEVELOPMENT

ECONOMIC INTERRELATIONSHIPS BETWEEN REPUBLICS ANALYZED

Moscow EKONOMICHESKIYE NAUKI in Russian No 7, Jul 80 pp 66-70

[Article by A. Yablonskis, docent, candidate of economic sciences (Vilnius): "The Role of Economic Ties Between Union Republics In Evening Out Their Levels of Economic Development]

[Text] The socialist economic system, based on public ownership of the means of production, objectively makes it possible to promote the development of the country's national economy while constantly taking into account and dovetailing all-union interests with the interests of the union and autonomous republics in the fraternal alliance of peoples of the USSR. Each republic, while developing in accordance with its natural and economic resources and possibilities and historically formed traditions, takes part in promoting the productive forces of the whole country and raising the material and cultural standards of all working people.

As a result of consistent development of the whole national economy of the USSR, past considerable differences in the levels of economc development of individual republics and regions have been overcome. Solution of this task was assured by the development of the economy of the USSR as a single national economic complex in which the resources of the whole country are utilized in a planned, centralized way. The transformation of the USSR into a highly developed industrial state was accompanied by accelerated progress of the productive forces of each region and the evening out of the levels of economic development of all union republics. At present the economy of each of them is an immediate component of the planned developing national economy of the USSR, an essential element in the socialist territorial social division of labor.

The economy of the USSR is at present characterized by basically the same level of the productive forces in all its republican and regional elements. In the conditions of developed socialism there are no substantial differences between the union republics in the per capita output of the national income and industrial produce, in labor productivity or in the power-worker or electricity-worker ratio. The republics have in the main reached the same indicators in the development of the main productive force, the working people themselves. It is in such conditions that each Soviet republic now performs as an organic component of the overall national economic complex of the USSR.

The evening out of the levels of economic development of the union republics, nations and peoples of the USSR has introduced substantial changes in the character of economic relations between the republics. Whereas in the past the main element in them was the help of the economically more developed republics to the less developed, at the present stage the main content of these relations is increasingly multilateral cooperation. In developed socialist society there takes place the integrated, concerted development of the economies of all the Soviet republics in the system of all-union division of labor and on the basis of the economic laws and regularities inherent in socialism. A situation has developed in which each republic is able to develop its economy mainly out of its own accumulations, when its independence in running its economy is objectively expanding. In such conditions, the development and improvement of economic cooperation between the republics and regions of the country in the framework of a unified national economic complex, far from declining, becomes ever more important. The one-directed development of the economies of the republics coordinated on a planned basis on the scale of the whole country is not only a prerequisite of the further strengthening of the whole national economic complex but also a decisive factor of successful economic and general social development of each republic.

Inter-republican economic relations in the framework of the unified economy of the USSR is one of the forms of intra-economic relations. The latter are an important aspect of the production relations of socialist society and a component of social reproduction assuring divisions of labor between different areas most favorable for the socialist society. Intra-economic relations promote territorial, as well as intra-industrial and inter-industrial divisions of labor and brings the manufactured products to their consumers. At the same time, it is through intra-economic relations that consumption of products reciprocally influences their manufacture. Thus, the rational organization of intra-economic relations in keeping with the objective conditions and economic laws of socialism is a necessary and important condition for the successful development of social production and the enhancement of its effectiveness.

Specific for the interactions between the union republics within the system of intra-economic relations of the USSR is, in the first place, that it is of a pronounced integrated character: it takes place not only within individual branches of production, not only between industries, and even not only between different economic areas of the country. The economic interrelationships between the union republics of the USSR are relationships between certain complexes of industries and manufactures representing the economy of each republic. As one of the forms of intra-economic relations they include inter-republican, intra-industrial, inter-industrial, and territorial relations as component parts. This imposes special demands on their organization: constant and unconditional correspondence with the principles of Leninist national policy, and constant consideration of both the interests of the whole Soviet Union and the Specific interests of each republic. Organization of inter-republican economic relations requires the coordinated activity of central and republican planning and economic administrative bodies, and close coordination of economic administration in the various republics and economic areas of the country.

An important form of inter-republican economic ties is collaboration between republics in production specialization and cooperation, joint construction of economic projects, and in developing natural resources. Collaboration in production means direct development and utilization of the productive forces on the scale of the Soviet Union as a unified economic system. Diversified economic collaboration of the republics also promotes greater trade, which as a whole reflects the development of inter-republican economic ties.

The rapid economic development of the union republics over the last decade was accompanied by the rapid expansion and growing complexity of economic relations between them. Substantial quantitative growth was accompanied by far-reaching qualitative changes in inter-republican economic relations. The share of industrial and agricultural produce of the union republics exported beyond their borders is increasing; at the same time the proportion of imported goods in industrial and individual consumption is growing, assortments of imports and exports are steadily expanding, and their structure is changing. These trends are objectively due to and reflect the ever expanding and strengthening economic collaboration of the union republics, the merging of their levels of economic development.

The Baltic republics entered the USSR in 1940. Within a short historic time, with the help of all the union republics, they not only built socialism but also created a developed socialist society. Speaking at the ceremonies in connection with the 50th anniversary of the USSR, Comrade L. I. Brezhnev mentioned the development of the Baltic republics as a vivid example of the great strength of the socialist system and the relations of friendship and brotherhood among peoples inherent in it. Lithuania, Latvia and Estonia, Comrade L. I. Brezhnev noted, "could not, at the time of their accession to the Union... be listed as backward national hinterlands. But when they took to the socialist party they demonstrated the highest rates of development in the Union... Such remarkable growth proved possible only along the road of uniting these republics with the other republics of the Union."*

The economic and social advance of the union republics of the USSR, including the Baltic republics, is vividly illustrated, in particular, by the economic development of Soviet Lithuania. Its area is 0.3% of the total area of the USSR, its population is 1.3% of the population of the USSR. In 1978, the republic's share in the country's gross national product was 1.5%, that is, somewhat higher than the proportion of its population.

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*L. I. Brezhnev. "Leninskim kursom. Rechi i statyi" [Following Lenin's Course. Speeches and Articles], Moscow, 1974, vol. 4, pp 55-56.

In the absence of any major mineral resources and with a shortage of energy resources, there is no place for many branches of heavy industry in Lithuania. However, production conditions in the republic are very favorable for developing branches of the manufacturing industries. A great part in the economy of the Lithuanian SSR is played by specialized precision machine building: electric technology, electronic, machine-tool and instrument building. Some establishments of these industries are fully specialized on an all-union scale. The food and light industries have been developed extensively.

In socialist conditions industry has become the main branch of the republic's economy. In 1978, its gross output was 54 times greater than in 1940.

The republic's requirements for raw materials, primary products and means of production are fully met from the resources of the national economy of the whole Soviet Union. The opportunities for marketing produce on the huge internal market of the country are virtually unlimited. This has facilitated not only the rapid growth of the productive forces of Lithuania but also the expansion of her links with virtually all regions of the country. Economic ties are strongest, in respect of both exports and imports, with the Russian Federation, specifically, its northwestern and central economic areas. Commodity exchanges with the RSFSR span the whole assortment of imports and exports and account for more than 50% of the total commodity turnover with other republics of the country. Commodity turnover between Lithuania and the Ukraine accounts for some 15% of the total, the other Baltic republics account for 13%, Byelorussia, for 7%, the Transcaucasian republics, for 2%, the republics of Central Asia, for 3%, Kazakhstan, 2%, and Moldavia, 1.5%.

Industrial goods manufactured in the Lithuanian SSR have won extensive international recognition: they are exported to 84 foreign countries. Some 70% of the exports are to the socialist countries and 20% of the developed capitalist countries.

Imports and exports of industrial products span a wide assortment of producer and consumer goods. The highest proportion are goods manufactured by the machine-building, light and food industries. An important place in exports belongs to products of the metallurgical, fuel, chemical and lumber industries.

Inter-republican exchange of commodities of different industries takes the form of both "pure" export and import and assortment exchange. Through the latter the republic receives various commodities of the machine-building, light, food and fish industries. As for commodities of the metallurgical, fuel and porcelain-earthenware industries received from outside the republic, they are almost totally "pure" imports. The structure of commodity exchange of manufactured goods, their exports and imports is presented in the table.

Imports and Exports of Industrial Produce by the Lithuanian SSR
in 1977 (percentage of total cost)

	Source		Consumption	
	Produced in republic	Imports	Exports	Consumed in republic
Electric power	91.6	8.4	10.7	89.3
Fuel	25.3	74.7	17.9	82.1
Iron and steel and nonferrous metals	20.1	79.9	9.1	90.9
Chemical industry	41.8	58.2	30.1	69.9
Machine-building and metal-working	73.0	27.0	61.7	38.3
Lumber, paper and pulp	77.9	22.1	26.1	73.9
Building materials	92.6	7.4	10.1	89.9
Glass, porcelain, earthenware	35.5	64.5	19.9	80.1
Light industry	71.0	29.0	33.6	66.4
Food industry	87.0	13.0	21.6	78.4
Other industries	73.7	26.3	8.9	91.9
Total	70.0	30.0	26.6	73.4

It can be seen from the table that the fuel industry, iron and steel and nonferrous metallurgy, and the chemical industry operate mainly on imported raw materials and primary products. Other industries, for example, machine-building and metalworking, and in part the light and pulp and paper industries, also consume a relatively high proportion of imported raw materials. On the other hand, building materials and the food industry utilize mainly domestic raw materials. The data in the table are convincing confirmation of the importance of imports and exports of industrial products for the normal development of the republic's economy and its effective participation in the all-union division of labor.

In analyzing the structure of commodity exchange it is necessary to note that industrialization of the republic's economy and the development of its productive forces promoted the creation of new branches of machine-building which now lead in both exports from the republic and total imports and exports. The republic exports output of subindustries of machine building of all-union specialization: machine tools, instruments, radio-electronics, farm machinery, shipbuilding, electrical technology, and others. The Lithuanian republic is today the country's main supplier of highly efficient units for the manufacture of vitamin grass meal which can harvest green feed in any weather and make grass meal with the least losses of nutrient substances. Household refrigerators manufactured in our country are supplied with small electric motors manufactured in Lithuania. It manufactures 90% of the household electricity meters, 70% of the electric motors for washing machines, and 60% of the arc welding machines.

The republic's traditional industries, light and food, follow machine-building in inter-republican exchanges of industrial produce. The last few years have seen not only a change in the structure of commodity exchanges between Lithuanian and other republics of the country, but also an increase in its volume: in 1977 exports were 4.5-fold over 1961, and imports were 4.4-fold.

Extensive economic relations in considerable measure determine the development of the republic's productive forces and are an important factor in the optimum specialization of its economy. As the industrial and economic potential of Soviet Lithuania continues to develop its economic ties will expand and improve. The growth of economic and cultural collaboration between the Soviet socialist republics is the earnest of the further blossoming of all nations and regions of the multinational Soviet state.

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INTRODUCTION OF NEW TECHNOLOGY

SPECIAL FUND FOR FINANCING NEW TECHNOLOGY DESCRIBED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 8, Aug 80 pp 82-89

[Article for discussion by V. Pokrovskiy, division chief of the State Committee for Science and Technology: "The Cost Accounting System of Organizing Work To Develop, Produce, and Introduce New Technology"]

[Text] The tasks of accelerating the development and introduction of improved machinery and equipment demand new forms of organizing this process, based primarily on elaboration and bolstering cost accounting (khozraschet) in the sphere of science and technology. The fundamental principles of cost accounting as a method of planned economic management do not preclude original forms of cost accounting relationships applicable to the special characteristics and conditions of the work of scientific research institutes and design bureaus.

The gradual transition of a number of industrial ministries to a new system of planning, financing, and economic stimulation of work related to new technology begun in 1969 promoted stronger cost accounting relationships among scientific institutions. The main criterion for selection of progressive types of articles and industrial processes and their introduction into production under the new system is the economic impact of their realization. As the principal form of planning and financing scientific-technical development within the ministry a system was adopted comprising schedule-orders (zakazy-naryady) that insure continuity and comprehensiveness in planning the stages of development, production, and introduction of new technology, planning of all material-technical resources and capital investment necessary to solve the problem, and participation by enterprises in working out the problem.

The ministries are forming unified funds for the development of science and technology (UFDST's) out of deductions from part of the profit from production and economic activities. The amount of capital put in a unified fund is determined depending on the volume indicators of production in the sector. In this way the amount of spending for science is tied to the results of a ministry's production and economic activity.

Material incentive funds at scientific research, planning-design, and technological organizations are envisioned for: sociocultural measures and housing construction; organizational development; bonus payments for the development of new technology depending on the total economic impact actually received in the national economy from its use.

The sectors that have been using this system of planning and economic stimulation for a significant time are enjoying accelerated growth in the efficiency of introduction of scientific-technical measures and production of high-quality output. In the electrical equipment industry, for example, the average annual growth in the national economic impact is more than 20 percent or roughly 1.2 billion rubles. The proportion of output bearing the state Mark of Quality within total production volume is several times greater than the USSR average. Each year 1,200-1,700 new types of articles are introduced, whereas in 1968 the total number was just 685. According to figures for the ministries the time of development and introduction of new technology has been reduced 20-40 percent in the Ministry of Electrical Equipment Industry, 30 percent in the ministries of Power Machine Building and Heavy and Transport Machine Building, and 1.5-2 times for certain major scientific-technical problems.

The positive working experience of the ministries that were switched to the new system of planning and economic stimulation led in January of this year to adoption of instructions for transferring the scientific research, design, planning-design, and technological organization, experimental enterprises, and science-production and production associations (or enterprises) of all industrial sectors to the cost accounting system of organizing work on the development, production, and introduction of new technology based on schedule-orders (or contracts).

This is one of the most important measures among the program of steps adopted to meet the requirements of the document "Basic Directions of Development of the USSR National Economic in 1976-1980" with respect to broad use of the target program method in planning. The necessity of an orientation to good final results and making achievement of these results more dependent on intermediate links, on the system of intrasectorial and intersectorial links, makes the broadening of the methods of target (program) planning and management natural and logical.

Target program planning insures the interdependence of the management system at all levels: national economy, sector, and primary element (scientific institutions, science-production and production associations and enterprises). The schedule-orders must become the most common form of realizing the principles of target program planning and management. The bulk of new technology will be developed and introduced on the basis of these documents.

Universal use of schedule-orders requires taking a number of steps to raise the level of cost accounting independence and organize the activities of sectors, associations, scientific institutions, and enterprises. Foremost among these steps is modifying the procedures for financing the development, production, and introduction of new technology. Financing must be organized so the resources are directed to work on scientific topics, scientific-technical problems, and projects which are oriented to good ultimate results for the national economy.

Experience shows that the cost accounting source of financing for new technology, the UFDST, meets these requirements. The UFDST is a fundamentally new form of financing spending for science and technology, based on a combination of centralized and cost accounting principles. Its development made it possible to establish concrete sources of financing and procedures for forming capital earmarked for the development and introduction of new technology. The intraministry schedule-order is now the basis for financing the work. Moreover, the formation of a unified fund is a major step toward formulating a system for financing scientific-technical progress on the basis of five-year plan assignments in conformity with cost accounting principles of management. The operational economic independence of the ministries with respect to spending for work on new technology has been enhanced because the unused part of the fund is not withdrawn and may be used in the next year.

The UFDST not only expands the operational economic independence of the ministries with respect to the use of capital for development and production of new technology but also insures unity of financing sources for work in the cycle from development to incorporation in production, allows operational redistribution of capital in stages of this cycle, and intensifies the accountability of ministries and scientific organizations for efficient use of the fund.

According to information from the Ministry of Electrical Equipment Industry, only by organizing start-to-finish planning on the basis of uninterrupted financing from the UFDST was it possible to develop and build the A-4 series of asynchronous engines in a short time (four years); the previous A-2 series took 12 years to develop and put in production.

Use of UFDST's increases the concentration of finance capital. For example, in the chemical industry the proportion of projects valued at more than 1 million rubles rose from 41 to 60 percent in four years. Small projects are generally carried out for other sectors based on economic contracts.

The unified fund also promotes a rise in the proportion of work that creates a backlog of scientific projects. Between 1968 and 1979 in the electrical equipment industry, for example, the backlog increased approximately 2.5 times, while from 1972 to 1978 it rose more than 1.5

times in heavy and transport machine building and almost four times in the chemical industry.

The source for formation of the unified fund is profit; only in isolated cases may prime cost operate as such a source.

At the present time the unified fund is a cost accounting fund only within the framework of the sector, because only some of the highly profitable enterprises and associations participate in its formation. The purpose of forming the UFDNT is to afford the ministries the right to maneuver freely with capital depending on the need to use it for particular types of work. Therefore, it is not wise, as is sometimes proposed, to establish norms for distribution of fund capital by stages of the research-development cycle for a long period of time within the framework of the sector and the individual associations (or enterprises). This ratio should be determined by the sector itself according to its concrete needs at a definite period, in conformity with plans for scientific research and incorporation of new technology.

The formation of unified funds for the development of science and technology in the sectors is a necessary condition for widespread implementation of the cost accounting system of developing, producing, and introducing new technology on the basis of schedule-orders. By orienting the schedule-orders to achieving good final results the sectorial scientific organizations are switched to a system of payment for projects that are completed and accepted by the purchasers and the indicator of "economic impact from scientific-technical activities" ratified by the industrial ministries for associations and enterprises in the five-year plans of economic and social development is introduced in practice.

The instructions on switching sectorial scientific research, planning-design, technological, and planning-surveying organizations to the system of payment for work that is completed and accepted by the purchaser show scientific institutions how to introduce planning for the volume of work completed and accpeted (not work underway) and set up a procedure for taking account of projects that are completed but not introduced in production. This establishes conditions for objective monitoring of introduction by higher-ranking bodies. They will determine if the results match the requirements envisioned in the schedule-order and identify the causes of delays in introduction or failure to introduce and the economic loss from this. Recording completed but not introduced work creates the prerequisites for planning accelerated introduction of such projects.

The system of payment for work that is completed and accepted by the purchaser significantly improves the efficiency of use of schedule-orders. It is important, therefore, that most of the scientific organizations be able to switch to this system in the first two years of the 11th Five-Year Plan.

It can be broadened in the future, certainly, to assignments for solving key scientific-technical problems by setting up a procedure in which capital is issued to ministries (departments), associations (enterprises), and organizations in the form of bank credit authorized by the State Committee for Science and Technology and handled by USSR Gosbank institutions.

The five-year plans of economic and social development for ministries, associations, and enterprises will plan indicators of the technical level of production and most important types of products produced as well as the economic impact from carrying out scientific-technical measures (this has already been done on an experimental basis in the electrical equipment industry, agriculture, and power and heavy machine building). With introduction of the latter indicator at all levels associations and enterprises have a stronger interest in the plan's including those projects related to new technology which will insure meeting the assignment established by the plan for economic impact. This also orients sectors, associations, enterprises, and organizations to development of schedule-orders for the projects that will provide the best final results.

The efficiency of new technology today, of course, is defined in the process of technical-economic substantiation during selection of the topic or program for inclusion in the plan. In most cases, however, the developers view this stage as a matter of substantiating inclusion of the topic in the plan. As a result the procedure for evaluating the efficiency of new technology is simplified, expenditures related to the new technology are usually understated, and the prospects for the extent of its use in the national economy are exaggerated. This approach often leads to new technology that costs significantly more than similar technology in use while it is just 20-30 percent more productive.

In our opinion, the new procedure for planning the volume of completed work and the economic results of introducing scientific-technical steps will greatly strengthen the incentive for management bodies, when making the decision to develop new technology and ratifying the corresponding schedule-order, to select new technology by the criterion of efficiency.

The schedule-order system makes it possible to concentrate the resources and efforts of the collectives of scientific institutions, associations, and enterprises on development of the more progressive scientific-technical ideas. This greatly facilitates the development of technology on a higher technical and quality level which has a greater national economic impact.

The head institutes have the paramount role in concentrating efforts on achievement of good final results as defined in the schedule-order.

A decision of the State Committee for Science and Technology has significantly broadened the administrative and economic rights of these institutes with respect to the following:

a. influence on organizations performing work jointly;

b. determining the volume of capital investment and material-technical resources when formulating plans for solving the appropriate problems;

c. selecting science leaders (main designers);

d. financing work on schedule-orders, programs, and assignments given to the head institution;

e. accepting work done by joint performers;

f. determining the efficiency and ceiling wholesale prices for new technology in the assigned special area;

g. establishing the amount of incentive payments to joint performers.

These steps will unquestionably have a positive effect on the rate of introduction of the cost accounting system of organizing work on the development, production, and use of new technology on the basis of schedule-orders, which will therefore affect the rate of performance of this work also.

The status of the schedule-order as the sole planning document comes from the fact that it is issued for multifaceted topics of the five-year (national economic and sectorial) plans for research, development, production, and introduction of new technology as well as for annual assignments and projects envisioned by these plans. When it becomes necessary during a five-year plan to develop new, multifaceted topics of national or sectorial importance, which are usually involved with development of a specific new item, material, or piece of production technology, a schedule-order is set up for the particular case.

In our opinion, when all the sectors have switched to the cost accounting system schedule-orders should also be issued for scientific research, experimental design, and technological projects of independent significance, not related to specific articles, industrial processes, and materials. It is wise to draw up contracts for work done by the organizations (enterprises) of other ministries and departments.

The schedule-order should stipulate: the assignments (jobs, stages) of the comprehensive topic and final results; the technical-economic parameters and specifications of the new technology being developed (including the ceiling price); time for development of the comprehensive topic (assignments, jobs, and stages); capital and resources (including capital investment) by years and total bonuses for fulfillment of assignments (jobs, stages). In our opinion it would be wise to establish standard stages of performance of work for the ministries and departments in conformity with this structure of schedule-orders for the development of articles, industrial processes, and materials and for scientific research, experimental design, and technological work. It is important here not only to take account of the characteristics of the particular sectors (and subsectors) and the experience already accumulated by some science-production associations such as Plastpolimer, Agropribor, and Pishchepromavtomatika, but also to insure that the standard stages of work done in the sectors correspond to the standard stages employed by the State Committee for Science and Technology in drawing up programs to solve key scientific-technical problems.

The technical administrations of the ministries can be charged with ratification of schedule-orders on topics which are comprehensive in nature and include all stages from research to incorporation of series production of the new technology, while all-Union industrial associations can ratify projects that carry out annual assignments of the comprehensive topic.

Changes in the topic list (specification of assignments, coordinating stages of work, their cost, times, and other parameters) should be made by the organization that ratified the schedule order, with the consent of joint performers of the topics (assignments, jobs, stages) who will be affected by the correction.

In our opinion, the ministries (departments) should give the head science-production and production associations and scientific research, planning-design, and technological organizations the right to issue schedule-orders for performance of jobs related to new technology and to ratify joint performers. This would enhance the accountability of these associations and organizations for fulfillment of work on the comprehensive topics assigned to them.

At the present time, only the associations and organizations of a given ministry that are responsible for development of the particular field of science and technology can act as the principal performer of a topic (who is also the holder of the schedule-order). But the broadening of intersectorial links in the area of developing and introducing new technology urgently poses the problem of planning work related to new technology on the basis of intersectorial schedule-orders. Their use will require significant changes in the rights and responsibilities of purchasers and performers and in methods of allocating and distributing financial and material-technical resources. Specifically, the head ministry (department) should be given the right to plan and redistribute all the resources allocated for performance of the assignments of an intersectorial schedule-order among the joint performing sectors.

In our opinion, it would be advisable to carry out local experiments in this area in the near future in oder to work out forms and methods of mutual relations among all participants in work based on interdepartmental schedule-orders. Later the sphere of actions of the schedule-orders could be broadened to include guaranteed servicing and repair of the technology built.

The organizations (associations) that issue schedule-orders and accept them for performance bear the full responsibility of purchasers and performers under a contract. The assignments of the schedule-order are obligatory for all participants in development of the topic, including industrial enterprises at which the developed results will be put into production. The assignments are the key constituent of the plan for introduction of new technology at the production association (enterprise). This principle should be stipulated in the Standard Methodology for development of the technical, industrial, and financial plan of industrial enterprises that have been switched to the new system of planning and economic incentive.

It is contemplated that measures related to the production and introduction of new technology will be included in plans for production and capital construction. During substantiation of drafts plans for associations (enterprises), data on the organizational-technical level of their production apparatus, the availability and level of utilization of capacities, recent history of technical-economic indicators, and other such information is taken into account. The Statute on the Passport of the Production Association (Enterprise) offers good opportunities for fuller consideration of this information when formulating the assignments of schedule-orders.

The ceiling price is a very important parameter of the schedule-order. Inasmuch as prices for new technology are shaped basically from consideration of prime cost and normative profitability, it is the customer who will benefit from use of a ceiling price in most cases. In our opinion, the USSR State Committee for Prices should insure that ceiling prices on new technology are set depending on the degree of improvement in use qualities it provides and the level of social costs of production. Then associations and enterprises will have incentive to replace and modernize their products at the proper time.

The transition to the system of schedule-orders presupposes rational use of scientific cadres. This requires improvements in certification and competitive selection of scientific workers, tying the period of their appointment to the time required for performance of specific work under the schedule-orders. The level of pay and incentive should be set depending on their certification.

The schedule-order defines the amount and sources of material incentive. This enables each employee to know in advance the amount of incentive payments and to relate them clearly to final results achieved. Economic stimulation of the collectives of workers who perform the assignments of the schedule-order should be based on the principle of giving them a right to receive part of the economic impact (profit) which they helped create.

In a number of sectors of industry the economic stimulation of scientific organizations and material incentive of their workers are directly dependent on the economic impact in the national economy resulting from use of the new technology, based on cost accounting relations among participants in the process of research-to-production. This practice can also be applied where schedule-orders have been introduced on a large scale, but on the condition that the performers of the work bear legal and economic responsibility for the parameters of the new technology which they guarantee and that purchasers bear the same responsibility for getting economic benefits from timely production and introduction of the technology. The last-mentioned consideration is especially important, because at the present time the economic potential of new technology is not used adequately in the national economy.

The question of the economic accountability of the performer and purchaser organizations can be solved, we feel, as follows. The amounts of stimulation of performers should be made dependent on compliance with the parameters (including economic impact) of the technology under development. In dealing with purchasers, it is possible to deduct the sums owing for bonus payments to performers from their bonus funds regardless of the actual volume of use of the new technology.

To prevent workers of particular sectors of the national economy from employing suboptimal decisions (where the desires of other sectors are considered secondary), it would be wise to authorize the managers of enterprises and organizations to transfer part of the capital in the centralized bonus fund for the development and introduction of new technology to other enterprises and organizations (regardless of their departmental affiliation) to pay bonuses to the workers who took part in the development of new technology contemplated by the national economic and sectorial plans. The ministries, departments, and kray and oblast executive committees should also be allowed to use part of the capital in this fund (for example, up to 10 percent) for bonus payments to administrative employees of the associations, combines, trusts, ministries, and departments who see that plans of work related to new technology are carried out.

The use of schedule-orders not only improves the efficiency of the new machinery and equipment being developed, but also has a beneficial effect on the productivity of scientific organizations, associations, and enterprises in development and use of new technology. This is because use of the schedule-order system demands adequate organization of work at the scientific research institutes, design bureaus, science-production associations, and enterprises.

The comprehensive creative brigade is a progressive organizational form for rapid reorientation of collectives to solving the pressing problems of production and introduction of new technology. At the Soyuzgazavtomatika Science-Production Association, for example, these brigades are composed of scientists, designers, and production workers who serve in them for the period of development and construction of the specific automated gas supply system. Material-technical and financial resources are provided by plan. The basic indicator used to evaluate the work of the brigade is turning over the completed work to the purchaser at the scheduled time; after this the brigade is disbanded or reorganized to perform a new project.

The degree to which a sectorial scientific institution works on schedule-orders (while fulfilling its pure, exploratory, and self-initiated projects in the established manner, of course) can, it seems to us, be used to characterize the extent of its orientation to the most important problems. Analysis of the concentration of efforts by scientific organizations on schedule-order jobs would enable the State Committee for Science and Technology, ministries, and departments to take steps toward a substantial improvement in their networks of subordinate institutions. Special attention here should be given to shutting down organizations, branches, and divisions that are not working efficiently and transferring them to the control of science-production and production associations (enterprises).

Thus, the transition of sectors to the cost accounting system of organizing work related to the development, production, and introduction of new technology demands implementation of a set of steps to pick out the subjects of the most important and highly efficient projects, formulate schedule-orders for them, and introduce a single source of financing for all the work in the cycle of research, development, and incorporation in production. This program also presupposes institution of payment for scientific research and development work that is complete and has been accepted by the customer. At the same time, the organization of work on schedule-orders must be substantially improved: enlarged rights for head scientific research institutes; broader introduction of flexible organizational structures; improved use and certification of scientific workers; incentive for collectives that are developing and introducing new technology.

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